



Armed Forces College of Medicine AFCM



Histological structure of small intestine (II)

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INTENDED LEARNING OBJECTIVES (ILO)



By the end of this lecture the student will be able to:

1. Enumerate cells lining the small intestinal crypts.
2. Correlate the LM & EM structure of cells lining the intestinal crypts to their functions.
3. Compare between the histological structure of duodenum, jejunum & ileum.
4. Describe the epithelial cell renewal in small intestine
5. Correlate the structural adaptation of the small intestine to its function.



Key points of this lecture

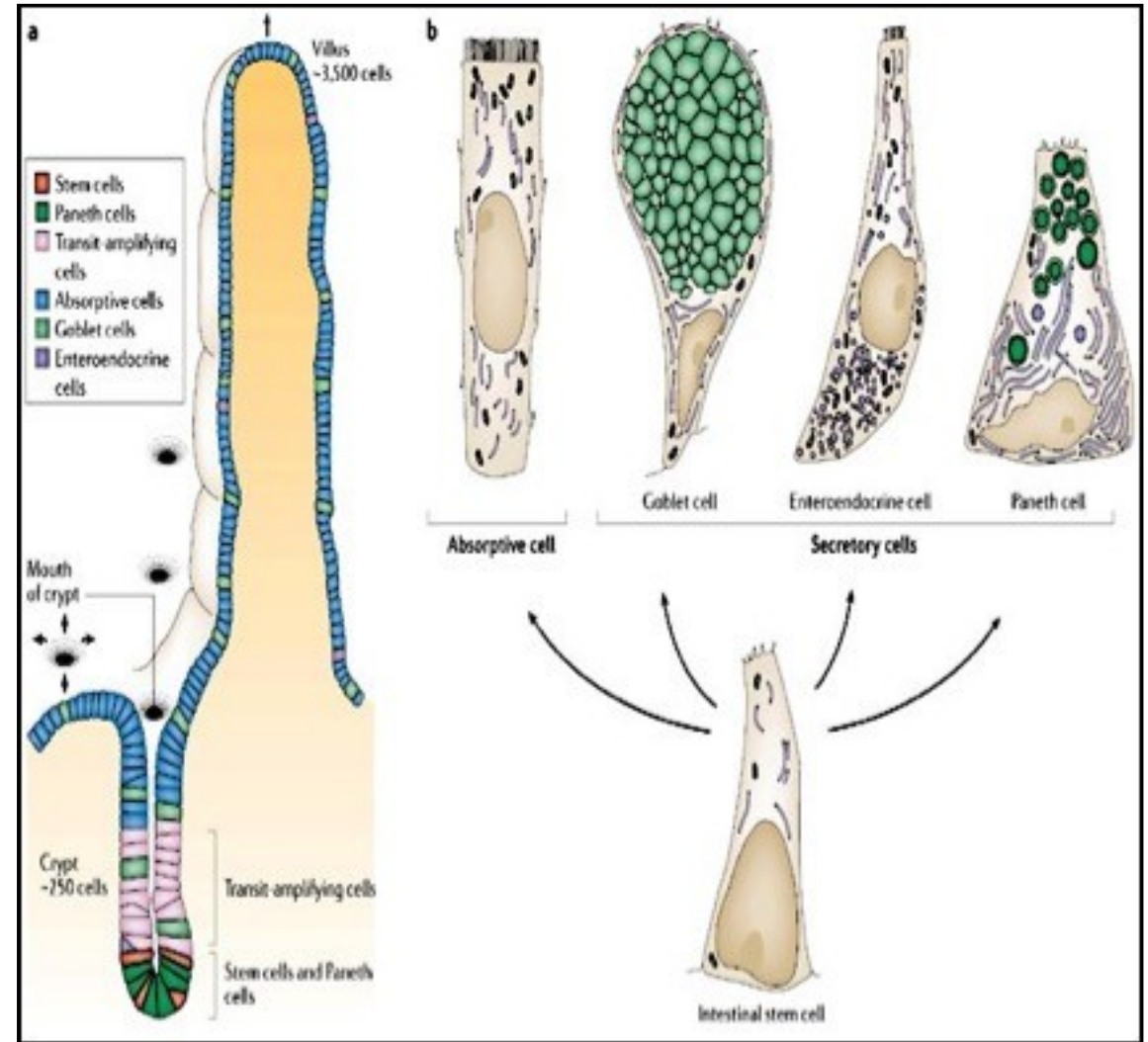


Structure of crypt base, Paneth cells and M cells.
Tracking of M cell defense mechanism.
Unique structure that characterizes the duodenum, jejunum and ileum.
How the small intestine structure adapt to its function.

Epithelial cells lining the intestinal crypts



- 1- Columnar absorptive cells (Enterocytes).
- 2- Goblet cells.
- 3- Enteroendocrine cells.
- 4- Paneth cells.
- 5- Crypt base columnar cells (Undifferentiated stem cells).
- 6- Membrane-like epithelial cells (M Cells).



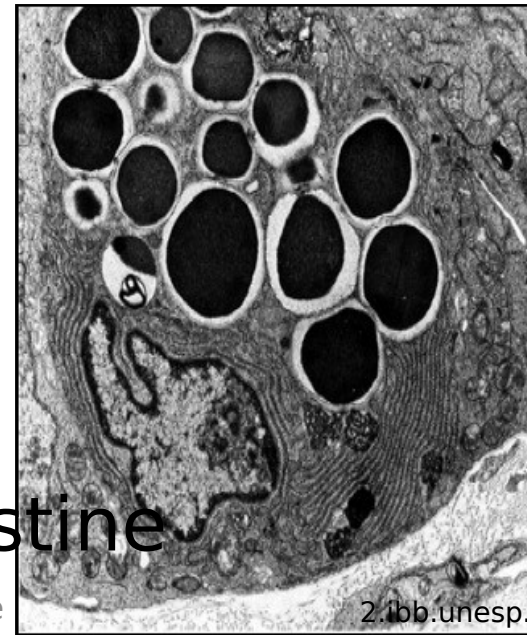
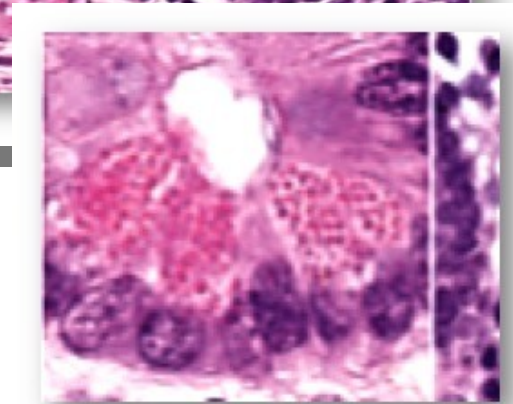
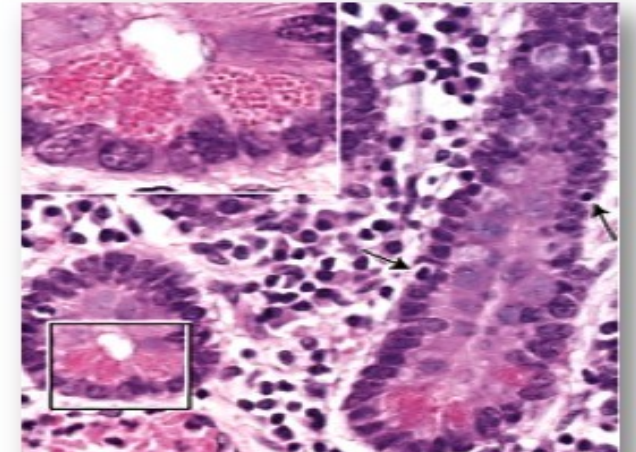
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Paneth Cells

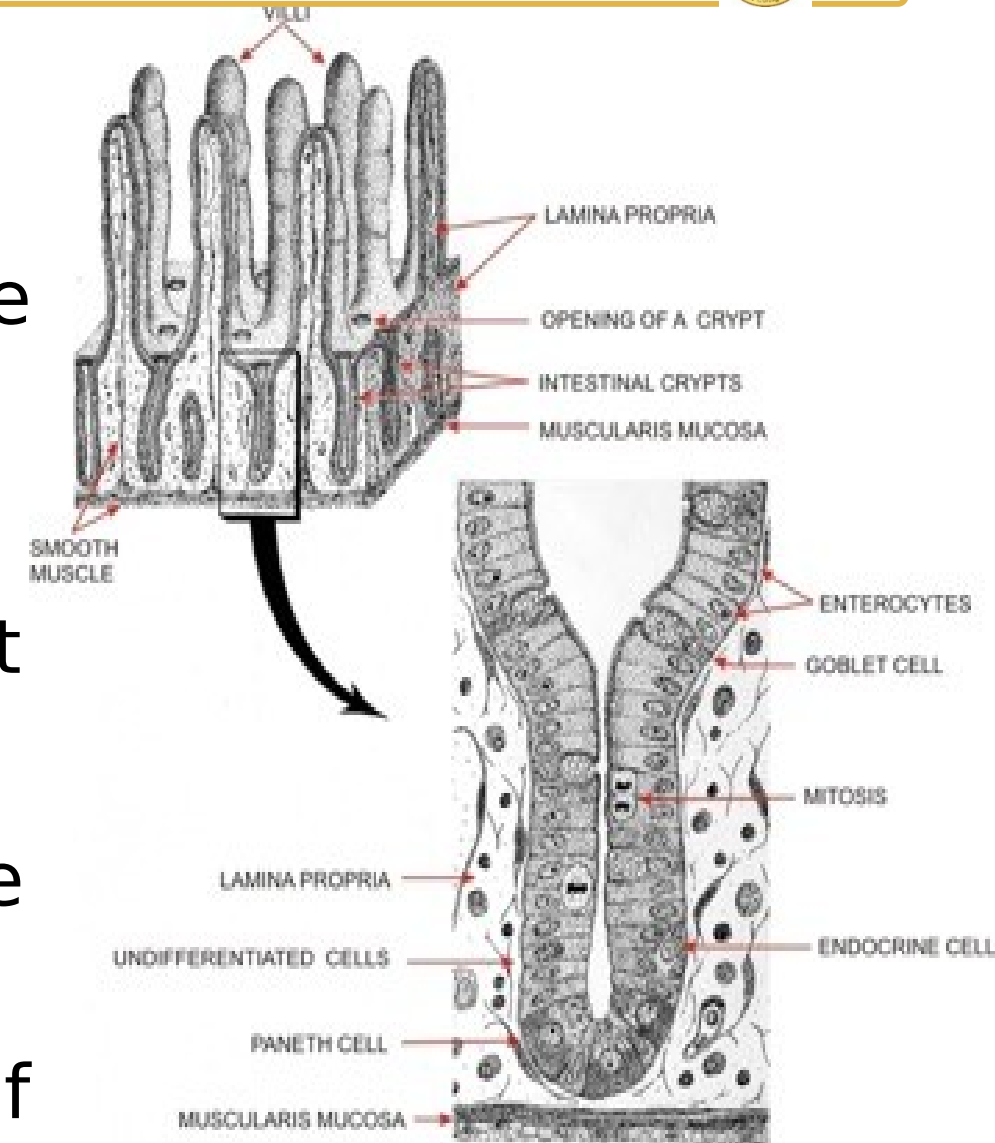
- **Site:** Present in groups, at the base of **crypts only**
[below the stem cells].
- **LM:** Protein secretory cell
- **EM:**
.....
 - Secrete:
 - Lysozymes (anti-bacterial).
 - Defensin proteins.
 - Regulate the bacteria flora of intestine





Crypt base columnar cells

- They are stem cells found mainly at the base of the crypts.
- **LM & EM:**
- Renewal rate of enterocytes and goblet cells = 4-6 days
- They divide in the crypts and reach the villous surface within one day.
- The epithelial cells migrate to the tip of the villous, then become lost into the intestinal lumen.



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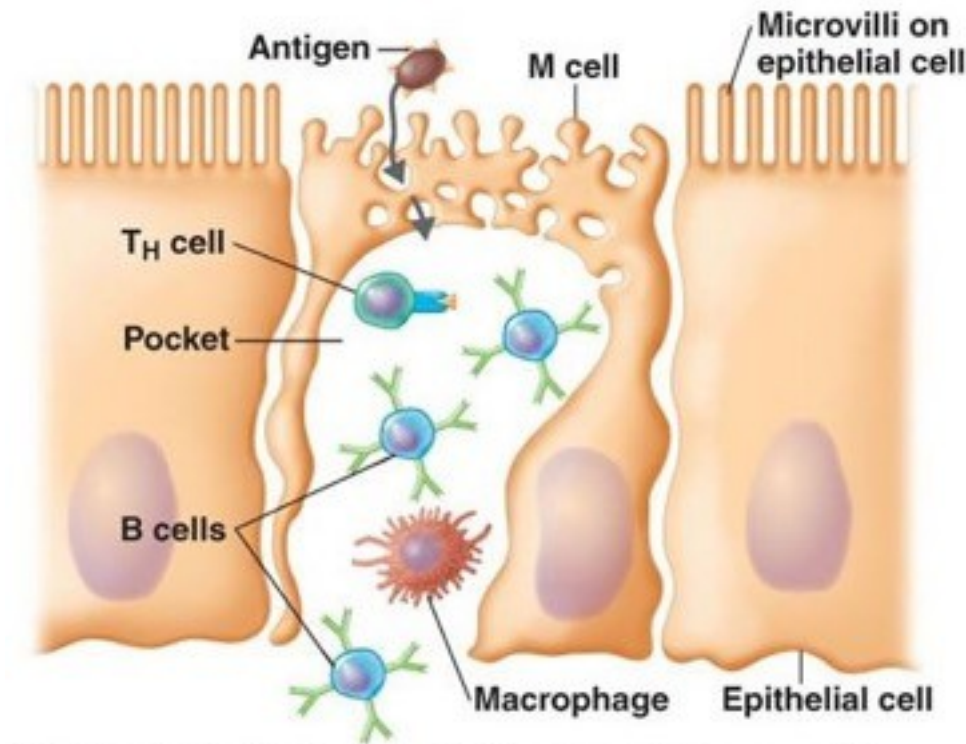
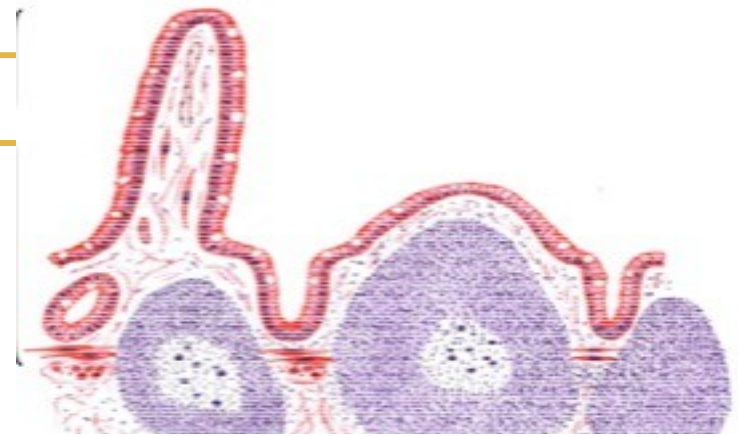
Cells of small intestinal crypts

Microfold Cells (M cells)

Site:

- Between the epith. cells of ileum overlying Peyer's patches.

L.M.: Can't be distinguished because they are very thin & stretched.



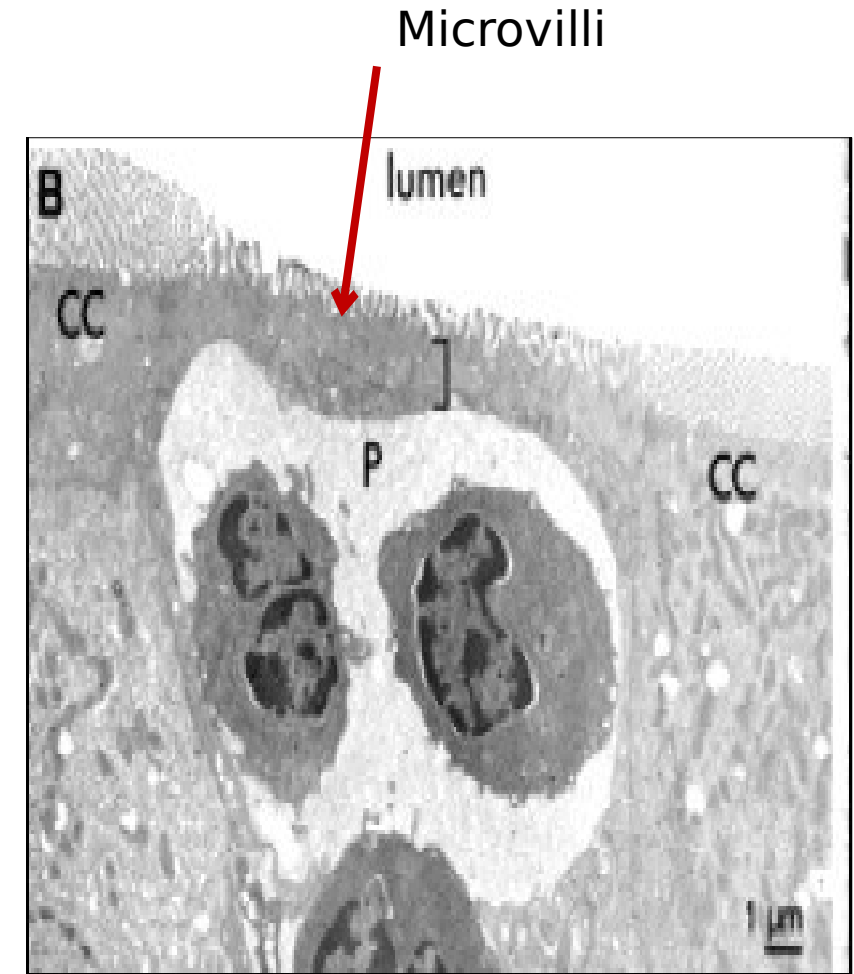
(b) M cells facilitate contact between antigens passing through the intestinal tract and cells of the body's immune system.





EM of M cells:

- Free borders: Show Small number of **microvilli**.
- Basal parts: show numerous basal membrane invaginations, forming **pockets (p)** containing **intraepithelial lymphocytes & macrophages**.
- Lateral borders: joined with the neighboring columnar cells (CC) by



.researchgate.net



Cells of small intestinal crypts



They are **Antigen transporting cell**

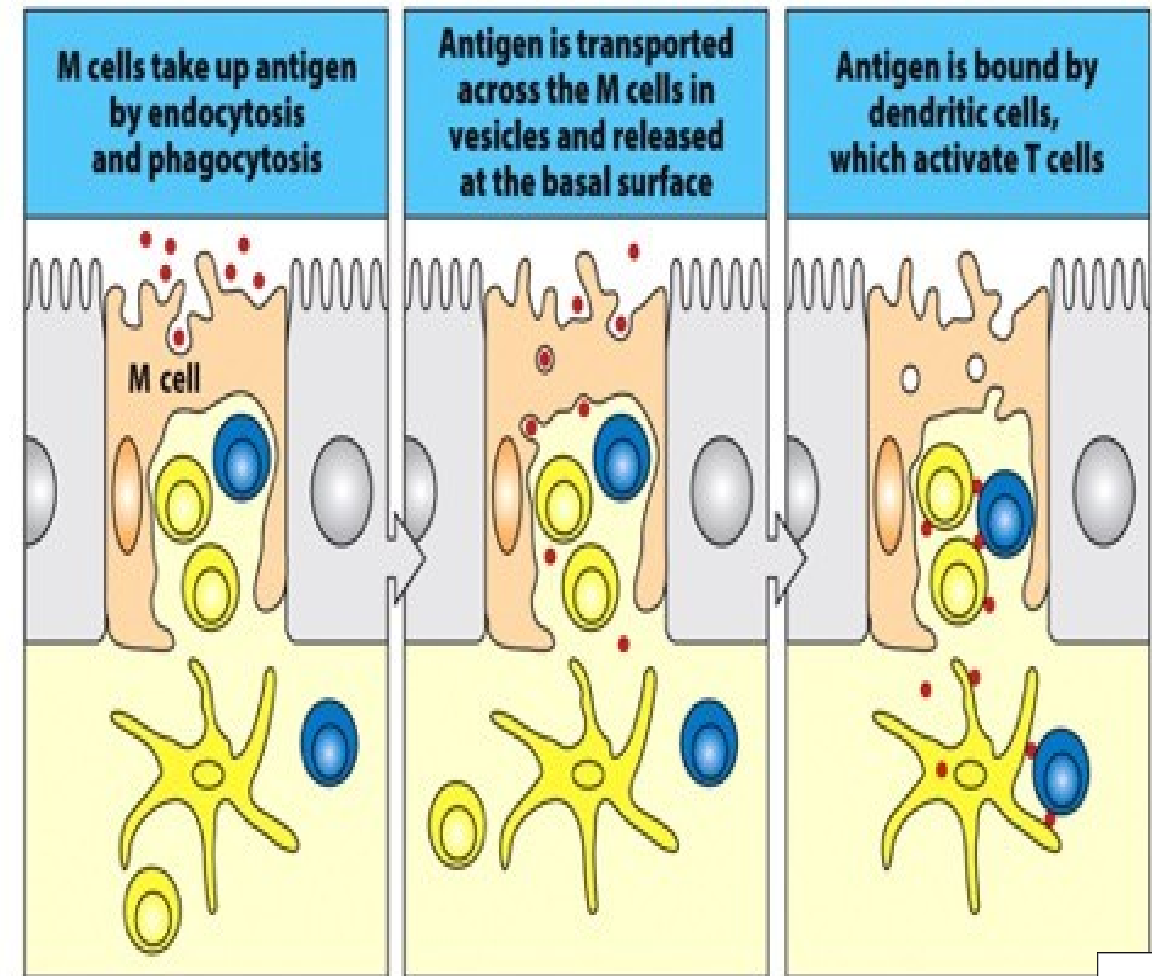
They phagocytose antigens
[present in the intestinal lumen]

Transports them across the
cytoplasm

Antigens bind to the underlying
lymphocytes & macrophages

These cells migrate to mesenteric
lymph nodes to initiate immune
response.

Antigen uptake and presentation by M cells



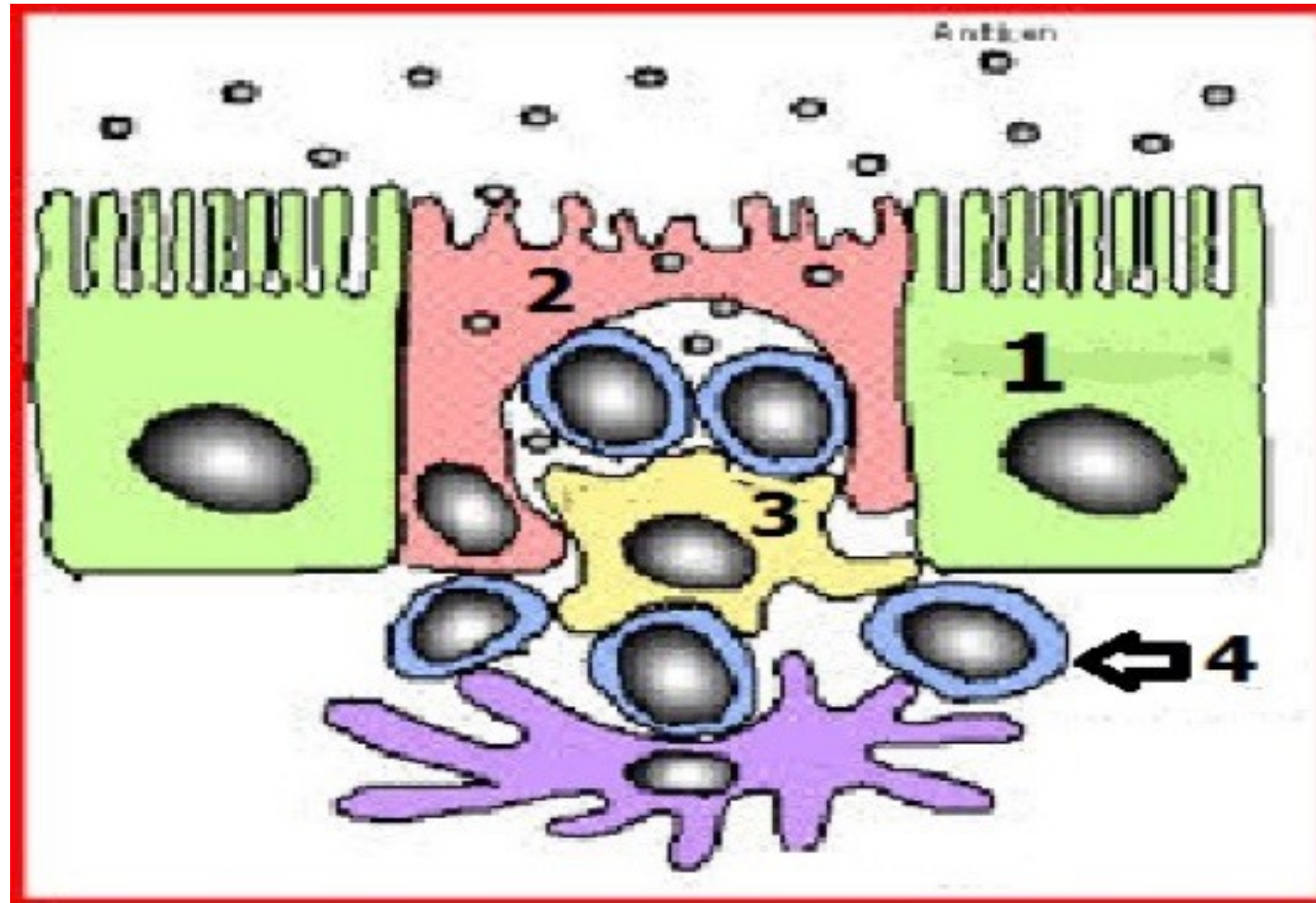
Lecture quiz



Which of the following uniquely characterizes the structure of the crypt base columnar cells?

- a) Basal infoldings.
- b) Apical brush border.
- c) Numerous diffuse ribosomes.
- d) Pocketing of the basal membrane.
- e) Basal basophilia with apical acidophilia.

Lecture quiz

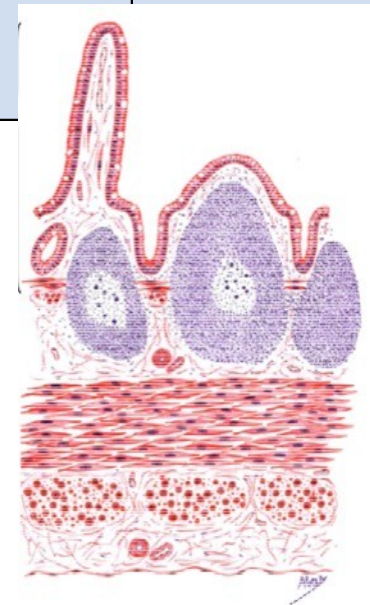
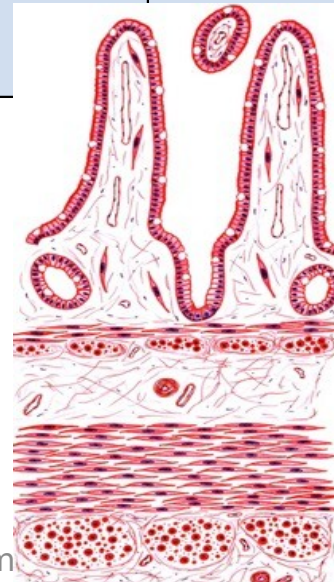
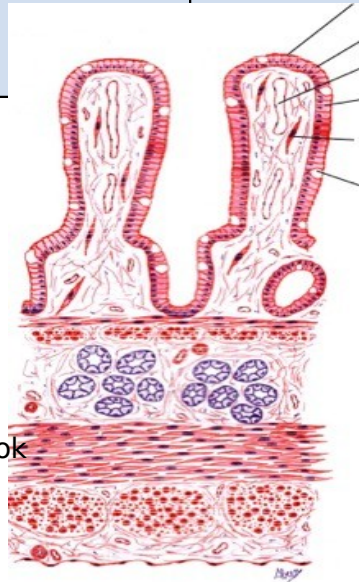


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Histological Differences between different parts of small intestine



Ileum	Jejunum	Duodenum	
<u>Least in number</u> <i>villi are short or absent over The Peyer's patches</i>	Long	Broad & <u>numerous</u>	Villi
<u>Numerous</u>	More	Few	Goblet cells
Peyer's patches	----- <i>just c.t. with Meissner's plexus as usual</i>	Contains Brunner's glands	Submucosa



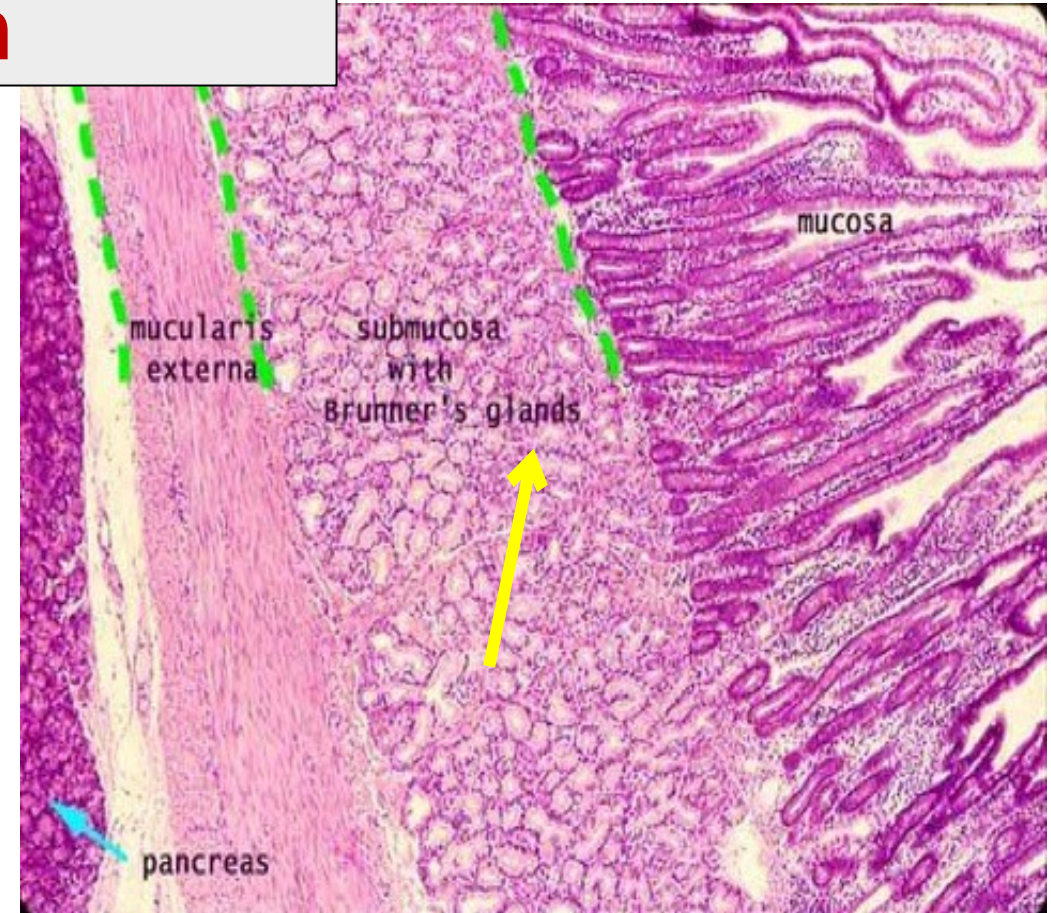
Brunner's glands of duodenum



They are submucosal mucous acini.

Secrete a **Mucous Alkaline fluid** that:

- 1) Helps **neutralize the acidic chyme** thus protecting the duodenal lining.
- 2) **Maintains PH** for pancreatic enzymes.



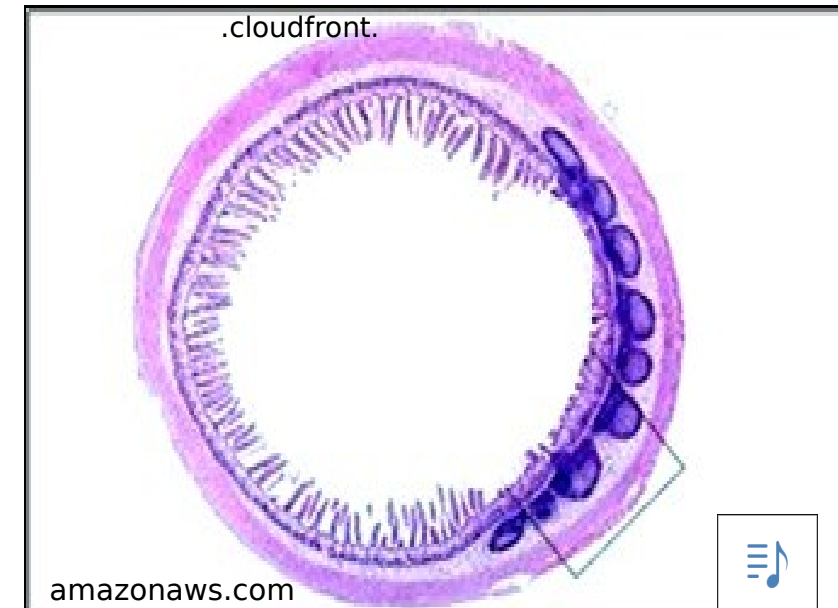
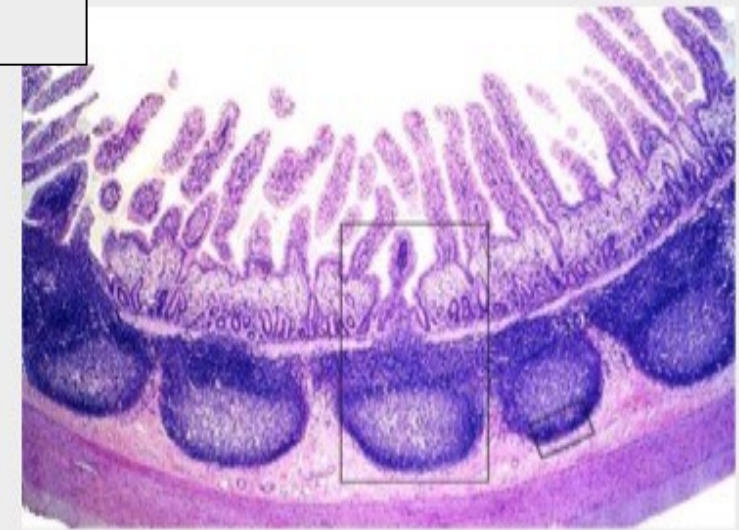
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Peyer's patches of ileum



- Large aggregates of Lymphatic nodules present in the **mucosa & submucosa of ileum**.
- Only on the **anti-mesenteric** border.
- Considered as one of the **GALT** (immune defense).
- The **villi** over Peyers' patches are ***short or absent***.
- The epithelial covering of these patches contains **M cells**.



Structure-function adaptation of small intestine



- A. Brush border of enterocytes :** contain Dipeptidases and disaccharidases
- B. sER in enterocytes:** for re-synthesis of TG during fat absorption process.
- C. Intestinal Crypts of Lieberkuhn:** secrete enzymes, hormones & mucus.
- D. Submucosal glands:** Mucus-secreting Brunner's glands in duodenum.
- E. Increase surface area for absorption:**
 - a) Intestinal length: 5 meters.
 - b) Plicae Circulares [Valves of Kerckring].
 - c) Intestinal villi
 - d) Microvilli
- F. Immunological Function:** M cells & Peyer's Patches.





Which of the following features characterizes the lamina propria of the jejunum?

- a) Peyer's patches.
- b) Meissner plexus.
- c) Central lacteals.
- d) Auerbach plexus
- e) Brunner's glands.



Lecture quiz



This is a section in the ileum.

- a) Which border is included in this section?**
- b) The identifying criteria are: ----- & -----.**



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Summary



Cells of intestinal crypts are:

- 1- Columnar absorptive cells (Enterocytes).
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- 4- Paneth cells.
- 5- Undifferentiated stem cells.
- 6- Membrane-like epithelial cells (M Cells).

The submucosa of **jejunum** **doesn't contain glands nor lymphoid patches.**

The **ileum** contain large mucosal and submucosal **Peyer's patches.**



Suggested textbooks



1- Junqueira`s Basic Histology; Text and Atlas. 14th edition 2016, pp: 314-317.

2- Histology atlas and test: Michael H. Ross and Wojciech Pawlina, 7th edition, 2015, pp: 572-581





**Thank
You**

Mahalo

Kiitos

Tack

Grazie

Toda

Obrigado

Takk

Thanks

Gracias

Merci

